A STUDY ON THE EFFECTIVENESS OF BALANCE EXERCISE IN IMPROVING BALANCE IN PATIENTS WITH DIABETIC NEUROPATHY

A dissertation submitted in partial fulfillment of the requirement for the degree of

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ELECTIVE – ADVANCED PT IN NEUROLOGY

(Reg. No.27091912)

RVS COLLEGE OF PHYSIOTHERAPY

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SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF "MASTER OF PHYSIOTHERAPY" AT THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY,

CHENNAI

(APRIL – 2011)

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INTERNAL EXAMINER

EXTERNAL EXAMINER

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DECLARATION

I hereby declare and present my project work entitled **"A STUDY ON THE EFFECTIVENESS OF BALANCE EXERCISE IN IMPROVING BALANCE IN PATIENTS WITH DIABETIC NEUROPATHY"**

The outcome of the original research work undertaken and carried out by me, under the guidance of Professor **Mrs. S. SEEMA MPT, RVS COLLEGE OF PHYSIOTHERAPY,** Sulur, Coimbatore.

I also declare that the material of this project work has not formed in any way the basis for the award of any other degree previously from the Tamil Nadu Dr. M.G.R Medical University.

SIGNATURE

ACKNOWLEDGEMENT

I express my thanks to God Almighty for providing me the wisdom and knowledge to complete my study successfully.

I acknowledge my sincere thanks to **CHAIRMAN and SECRETARY OF RVS EDUCATIONAL TRUST,** Sulur, Coimbatore for providing me an opportunity to do this project.

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I offer my grateful thanks for all the staff members of physiotherapy rehabilitation centre.

I also thank my friends for their co-operation in completion of this project.

I offer my thanks and gratitude to our librarians for their supports in providing books to complete my study.

I take this golden opportunity to thank each and every patient who took part in this study for their kind co-operation and needed information.

Finally, I would like to express my heartfelt thanks to **MY FAMILY** for their doubtless support and encouragement that enabled me to turn this idea into reality.

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1. INTRODUCTION

Diabetes mellitus was described more than 2000 years ago, once regarded as a single entity disease affecting individuals of higher socio economic strata but now even the individual of lower economic strata are also affected. It is a disease characterized by a state of hyperglycemia resulting from diversities of etiologies, environmental and genetic acting jointly.

By definition, diabetes mellitus is a syndrome characterized by chronic hyperglycemia and disturbance of carbohydrates, protein and fat metabolism associated with absolute or relative deficiency in insulin secretion and action.

According to WHO, there are two main types of diabetes mellitus ie insulin dependent diabetes mellitus (type I) and non insulin dependent diabetes mellitus (type II).

Type II diabetes mellitus is a syndrome having heterogeneous and is associated with risk of number of complication like neurological, cardiovascular, renal, ocular and musculoskeletal problems. Out of these neurological and cardiovascular systems are commonly affected.

Diabetes is systemic disorder of energy metabolism in which hyperglycemia is the cellular resistance to the effect of insulin or both. Diabetes affects both the central and peripheral nervous system.

Diabetic neuropathies are a family of nerve disorder caused by diabetes. People with diabetes can develop nerve damage throughout the body. About 60 to 70 percent of people with diabetes have some form of neuropathy. People with diabetes can develop nerve problems at any time, but risk rises with age and longer duration of diabetes for more than 5 years. They appear to be more

common in people who have problems controlling their blood glucose also called blood sugar.

Type II diabetes is the most common form of diabetes and usually appears in middle aged adults. Approximately 60-70% of type II individuals develop diabetic neuropathy. It is often associated with obesity and may be delayed or controlled with diet and exercise. Diabetic neuropathy appears to be more common in people over 45 – 55 years of age.

Causes:- Prolonged exposure to high blood sugar (glucose) can damage delicate nerve fibers, causing diabetic neuropathy. High blood glucose interferes with the ability of the nerves to transmit signals. It also weakens the walls of the small blood vessels that supply the nerves with oxygen and nutrients.

Metabolic factors, such as high blood glucose, long duration of diabetes and possibly low levels of insulin.

Neurovascular factors, leading to damage to the blood vessels that carry oxygen and nutrients to nerves.

Autoimmune factors that cause inflammation in nerves.

Clinical features:-

- Functional imbalance
- Deep pain most commonly in the feet and legs
- Numbness
- Muscle weakness
- Loss of sense of warm or cold

Based on this Clinical feature that is functional imbalance, subject were evaluated with berg balance scale, containing 14 balance tasks. Balance training to be an effective means of preventing falls in patients with diabetic neuropathy.

1.1 STATEMENT OF THE PROBLEM

This is a study on the effectiveness of balance exercise in improving balance in patients with diabetic neuropathy.

1.2 AIMS AND OBJECTIVES OF THE STUDY

To find out the effectiveness of balance exercise in diabetic neuropathy patients

1.3 NEED AND SIGNIFICANCE OF THE STUDY

Diabetic neuropathy or nerve damage is a fairly common diabetes related complication, about 60% of persons with diabetes have some degree of neuropathy and it is part of regular exams and screenings in persons with diabetes nearly all persons with diabetes will eventually have some form of neuropathy. Complication from neuropathy can range from mild to severe symptoms can include buzzing, burning or tingling paresthesia in the feet and increased risk of falling.

In this study Berg balance scale was used to measure balance by assessing the performance of functional tasks. This study evaluate the effectiveness of balance exercise to improve balance in patients with diabetic neuropathy.

1.4 HYPOTHESIS

NULL HYPOTHESIS

There is no significant difference in giving balance exercise to diabetic neuropathy patient.

ALTERNATIVE HYPOTHESIS

There is significant difference in giving balance exercise to diabetic neuropathic patient.

1.5 OPERATIONAL DEFINITIONS

DIABETIC NEUROPATHY:

Diabetic neuropathies are a family of nerve disorders that are associated with diabetes mellitus. These conditions are thought to result from diabetic micro vascular injury involving small blood vessels that supply nerves.

Neuropathy is a nerve disorder that results in distortion of nerve function.

TYPE II DIABETES:

Diabetes mellitus type II formerly called non insulin dependent diabetes mellitus or adult onset diabetes is a disorder that is characterized by high blood glucose in the context of insulin resistance and relative insulin deficiency.

It is a chronic disease characterized by high levels of sugar in the blood. It develops when your body does not respond correctly to insulin.

BALANCE:

The ability to align body segments against gravity to maintain or move the body (center of mass) within the available base of support without falling.

2.REVIEW OF LITERATURE

a) Review of literature related to diabetic neuropathy

- **RENUKA DHARMADHIKARI (2007)**

  Mellitus is a common disease in people with almost 50 % of type 2 diabetic patients being over 45 to 55 years of age. Insulin resistance is common in people, with large numbers also have impaired insulin secretion. Exercise with a particular emphasis on balance and stability is an important component of the management and treatment of diabetic neuropathy patients.

- **D. FEEDLE ,G. CUCINOTTA, DA GREENE (2005)**

  A common complication of diabetics called neuropathy was determined in diabetic patients recruited from 109 out diabetic clinics. An increased awareness of the high prevalence of neuropathy can lead to early therapeutic intervention and possible prevention of later neuropathic complication such as infection and foot ulcer.

- **ALI CIMBIZ , OZGE (2004**)

  Diabetic neuropathy disturbed especially the balance on the dominant leg. Done with sixty voluntary adults of both sexes from Kuhatya, Turkey were divided in to two groups. A type 2 diabetic neuropathic group (DG) and a non diabetic control group (CG) . The CG was selected to match the diabetic characteristics such as age, body mass and sex. Standing on dominant, non dominant leg and functional reach were used for the assessment.

- **STEFANO BALDUCCIAN, GIAN LUCA, LEOLCA PARISIC (2004)**

Exercise training can modify the natural history of diabetic neuropathy. This study suggests for the first time that long time exercise training can prevent the onset or modify the natural history of diabetic neuropathy.

- **MARK J BROWN, JOHN R. MARTIN, ARTHUR K, ASBURY (1996)**

Diabetic patients whose neuropathy was characterized by pain and autonomic dysfunction with loss of balance and preservation of muscle stretch reflexes.

- **YASUDA H DYCK P (1987)**

Hypothesized that neuropathy results from pathologic developments in the small vessels in diabetes by the observation of thickening of the walls of endoneurial capillaries in the nerve of diabetic patients as a result of an accumulation of periodic Acid Schiff.

b) Review of literature related to balance and diabetic neuropathy

- **ANN V. SCHWARTZ AND TERESA A. HILLIER (2001)**

People with diabetic had increased risk of falling in their study conducted in patients with diabetic neuropathy. Postural stability is the important factor to maintain the balance which reduces the risk of fall. Diabetic neuropathy subjects may lose their centre of pressure information for controlling postural sway in stance phase of gait.

- **HORAK FBB, DICKSTERIN R AND PETERCA R.J .(1998)**

Concluded that diabetic patients with neuropathy show higher range and root mean square value compared with those of control subjects and diabetic patients with out neuropathy quiet standing balance was investigated in 24 diabetic patients with or with out neuropathy with eyes opened and eyes closed.

- **DANIK LAFOND, HELENE CORIVEA AND FRANCIOS PRINCE(1998)**

Motor strategies at the ankle joint are altered in diabetic neuropathy patients in his work subjected for postural control mechanism during quiet standing in patients with diabetic neuropathy.

- **BEVERLEIGH H PIEPERSA(1996)**

Many as one in two people with type 2 diabetes eventually develops a condition of chronic nerve damage in their feet known as diabetic neuropathy . Diabetic are at greater risks for falls when they have fewer sensory inputs to compensate for the loss of feeling in their feet. Closing your eyes, or walking a across a dark room will result in more falls. Even standing on one foot is harder for a diabetic to do with their eyes closed, but easier if eyes are open.

- **TABASSOM GHANAVATI, ALI ASGHAR ARASTOO : (1995)**

Diabetic neuropathy patients seems to cause postural imbalance which may affect quality of functions and activities of daily living of these patients.

- **ROTHWELL (1994)**

Visual vestibular and proprioceptive subsystem response to slightly different disturbance in balance. The visuo spinal system controls both static and faster inputs with proprioceptive system which is also Sensitive to faster stimuli.

- **LORD ET .AL (1994)**

A study in Australia reported that poor balance is a factor in the causal pathway between diabetes and increase risk of falling. Thus the individuals with diabetes had increased body sway.

c) Review of literature related to effect of exercise programme on balance disorder

- **EMILY SPLICHAL : (1996)**

Diabetic neuropathy causes loss of distal strength and sensation. Research has shown that diabetics with neuropathy are 15 times more likely to report falling or stumbling in a one year period. Research has proven balance training to be an effective means of preventing falls in patient with diabetic neuropathy. All balance exercise can be done in a patient home with little or no equipment.

- **RICHARDSON J.K, SANDMAN D, VELA S.A(1995)**

Focused exercise regimen improves Clinical measures of balance in patients with diabetic neuropathy. Participants are twenty subjects with diabetes mellitus and diagnostically confirmed patient. Ten subjects underwent a 3 week intervention exercise regimen designed to increase rapidly available distal strength and balance. The other ten subjects performed a control exercise regimen. The intervention subjects but not the control subjects , showed significant improvement in all 3 clinical measures of balance that is impedal stance time, Functional reach and tandem stance time.

d) Review of literature related to berg balance scale

- **TRINA SMITH (2005)**

Berg Balance Scale used to quantify the balance of patients with diabetic neuropathy. Twenty one female and five males were selected. Participants completed each balance test once during 2 testing sessions for that inter rates reliability was good for the BBS. The balance test showed moderate to good reliability for this population. The BBS appear to be valid measures of motor ability to maintain balance.

- **GATEV (1999)**

Balance tests have been developed and presented to obtain appropriate information of balance measurement . The selection of measuring time and stance conditions is essential

- **ALEXANDER (1996)**

Balance test have been developed and presented to obtain appropriate information of balance capabilities during standing. Functional balance scales are easy to perform and suitable for daily clinical use that give more detailed information about balance .

- **BEIG ETAL (1995)**

Berg Balance Scale in patients with impairment of balance. It is a staff completed assessment scale of ability to maintain balance either statistically or while performing various functional movements to help make decisions about the patients balance level, comprises 14 observable tasks common to every day life.

3. RESEARCH DESIGN AND METHODOLOGY

3.1 REASEARCH DESIGN

This study belongs to experimental design .

3.2 VARIABLES USED IN THE STUDY

3.2.1 Independent variables

Balance exercise

Medical treatment

3.2.2 Dependent variable

Balance

3.3 SETTING OF THE STUDY:

Physiotherapy Rehabilitation Centre ,Kannur

3.4 CRITERIA FOR SELECTION

Inclusion criteria

- Diabetes with a duration of more than 5 years
- Type 2 diabetes with diagnosed neuropathy
- Individuals between the age group of 45-55 years were selected.
- Both males and females wee included in this study.
- Patients who reported atleast one fall in the past 6 months

Exclusion criteria

- Lower extremity amputation
- Patients with inability to walk without any assistive devices
- Patients with musculoskeletal impairment
- Patients with neurological impairment
- Diabetes with any other systemic involvement

3.5 SAMPLE POPULATION

30 Subject and 15 in each group

3.6 METHOD OF SAMPLING

Random Sampling Technique.

3.7 METHODOLOGY

30 Subjects are selected and divided in to two groups

The procedure was explained to subject.

GROUP A : Balance exercise with medical treatment

GROUP B: Medical treatment

3.8 MATERIALS USED

- Ruler
- Two standard chairs (one with a arm rests, one without)
- Foot stool
- Stop watch or wrist watch
- Berg balance scale
- Outcome measurement by using Berg Balance scale

3.9 DURATION OF THE STUDY :

Four weeks

3.10 PROCEDURE

The subjects were given balance exercise like static and dynamic exercise for five days for four weeks . Total treatment time was 60 minutes /session/ day with 5 minute rest after every 15 minutes.

Balance exercise

Improve balance by performing simple balance exercise. The single leg stance is a very effective exercise for improving balance. This exercise can be modified balance stability. The exercises are categorized in to two different types static and dynamic of balance training .

Static exercise

- Toe stand
- Tandum stand
- One – legged stand
- Heel stand

Dynamic exercise in walking

- Toe walk
- Tandum forward walk
- Heel walk
- Tandum backward walk

1. Toe stand

- Stand about one and a half feet away from the counter.
- Raise up as high as possible on the balls of your feet. Your feet should be shoulder width apart.
- Try to stay as still as possible. Do not move your feet around to maintain balance.
- Hold the toe stand for 10 seconds.

  Rest. Repeat 5 times.

2. Tandem Stand

- Stand about one and a half feet away from the counter.
- Place one foot directly in front of the other foot so that the heel of one foot is just touching the toes of the other foot.
- Try to stay as still as possible. Do not move your feet around to maintain balance.
- Hold the tandem stand for 10 seconds. Rest. Repeat 5 times.

3. One-legged Stand

- Stand about one and a half feet away from the counter.
- Slowly lift one leg off of the floor, while maintaining your balance with the other leg.
- Try to stay as still as possible. Do not move your foot around to maintain balance.
- Hold the one-legged stand for 10 seconds.
- Rest. Repeat with other leg 5 times.

4. Heel Stand

- Stand about one and a half feet away from the counter.
- Raise up as high as possible on the heels of your feet. Your feet should be shoulder width apart.
- Try to stay as still as possible. Do not move your feet around to maintain balance.

- Hold the heel stand for 10 seconds.
- Rest. Repeat 5 times.

Dynamic exercise

1. Toe walk

• Go to one end of a hall and slowly raise up as high as you can onto your toes. Walk down the hall on your toes.

• When you reach the other side, come down onto your feet and stand normally.

• Rest. Repeat 5 times.

2. Tandem Forward Walk

- Go to one end of a hall and place one foot in front of the other so that the heel of one foot touches the toes of the other foot.
- Walk down the hall in a tandem walk.
- It is important that with each step the heel of one foot touches the toes of the other. If you make a mistake, just place one foot in front of the other and continue down the hall.
- When you reach the other side stand normally.
- Rest. Repeat 5 times.

3. Heel Walk

- Go to one end of a hall and slowly raise up as high as you can onto your heels. Walk down the hall on your heels.

- When you reach the other side come down onto your feet and stand normally.
- Rest. Repeat 5 times.

4. Tandem Backward Walk

- Go to one end of a hall and place one foot behind the other foot so that the heel of one foot touches the toes of the other foot.
- Walk down the hall in a backward tandem walk. It is important that with each step the toes on one foot touch the heel of the other.
- If you make a mistake, just place one foot behind the other and continue down the hall. When you reach the other side, stand normally.

  Rest. Repeat 5 times.

3.11 MEASURING TOOL

BERG BALANCE SCALE

- The Berg Balance Scale (BBS) was developed to measure balance among people with impairment in balance function by assessing the performance of functional tasks.
- It is a valid instrument used for evaluation of the effectiveness of interventions and for quantitative descriptions of function in clinical practice and research.
- The BBS has been evaluated in several reliability studies.
- 14 items scale designed to measure balance of the adult in a clinical setting.

4. DATA ANALYSIS AND INTERPREATION

The data collected was subjected to paired 't' test individually for group A and group B using formulas.

Formula 1

$$\bar{d} = \sum d/n$$

Where,

d = difference between pre test and post test values

$\bar{d}$ = is the mean value of d

n = is the number of subjects

Formula 2:

Standard deviation SD =

$$\sqrt{\frac{\sum (d-\bar{d})^2}{(n-1)}}$$

Formula 3:

Standard Error (S.E) = $\frac{SD}{\sqrt{n}}$

't' calculated value = $\frac{\bar{d}}{S.E}$

Formula 4:

't' cal = $\frac{d}{S.E}$

Where, t cal is the 't' calculated value

$\bar{d}$ = mean of deviation

n = total number of subjects

s = standard deviation

Σd^2 = sum of squared deviation

4. Independent 't' test

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s}\sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

Where S = $$\sqrt{\frac{\sum (x_1 - \bar{x}_1)^2 + \sum (x_2 - \bar{x}_2)^2}{n_1 + n_2 - 2}}$$

$\bar{X}_1$ = Mean of Control group

$\bar{X}_2$ = Mean of Experimental group

n_1 = Number of Subjects in Control group

n_2 = Number of Subjects in Experimental group

S = Standard Deviation

Data were collected from 30 patients analysed using paired 't' test and Independent 't' test to find out within group difference. All data was analysed using SPSS version 10.0.

TABLE 1

DESCRIPTIVE DATA OF EXPERIMENTAL GROUP

S.No	Age Year	Sex	Berg Balance Scale	
			Pre-test	Post test
1	48	M	37	47
2	50	M	38	45
3	46	F	36	46
4	45	F	36	45
5	49	M	38	47
6	48	F	35	46
7	49	M	37	48
8	50	M	37	47
9	48	F	39	48
10	48	M	38	47
11	47	M	36	46
12	50	M	35	46
13	49	F	38	48
14	46	M	35	46
15	49	M	39	47

TABLE-11

DESCRIPTIVE DATA OF CONTROL GROUP

S.No	Age Year	Sex	Berg Balance Scale	
			Pre-test	Post test
1	47	M	38	41
2	46	M	38	42
3	46	M	36	41
4	47	F	37	37
5	48	M	35	37
6	49	M	39	42
7	48	F	39	42
8	48	F	38	40
9	50	M	36	39
10	49	M	37	40
11	46	M	38	41
12	45	F	37	40
13	47	M	36	39
14	47	F	39	42
15	49	F	37	41

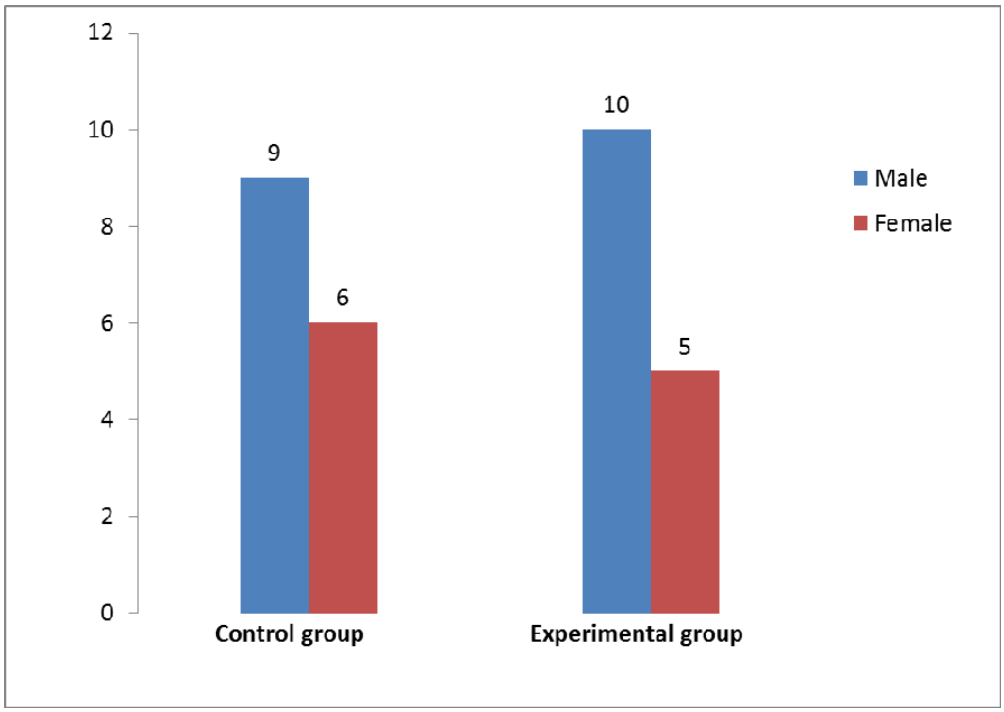
TABLE – II1

DEMOGRAPHIC PRESENTATION OF SEX

CONTENT	CONTROL	EXPERIMENTAL
Male	9	10
Female	6	5
Total	15	15

GRAPH- I

SEX WISE DISTRIBUTION IN CONTROL GROUP AND EXPERIMENTAL GROUP



The above bar graph shows, in control group 9 males and 6 females were selected; and in experimental group 10 males and 5 females were selected.

TABLE IV

PRE TEST MEAN AND STD. DEVIATION OF BBS CONTROL AND EXPERIMENTAL GROUP

GROUP	N (No. of Subjects)	MEAN	STD. DEVIATION
CONTROL	15	37.33	1.234
EXPERIMENTAL	15	36.93	1.387

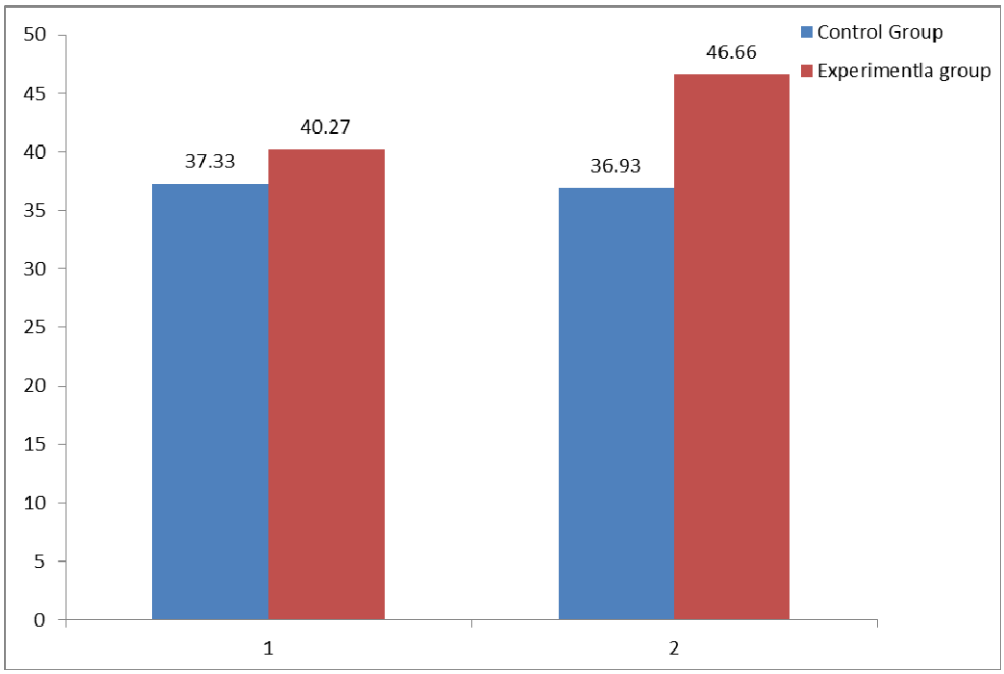
TABLE V

POST TEST MEAN AND STD. DEVIATION OF BBS IN CONTROL AND EXPERIMENTAL GROUP

GROUP	N (No. of Subjects)	MEAN	STD. DEVIATION
CONTROL	15	40.27	1.67
EXPERIMENTAL	15	46.66	1.051

GRAPH-II

MEAN DIFFERENCE OF BBS IN CONTROL AND EXPERIMENTAL GROUP



INTERPRETATION OF DATA:

STATISTICAL ANALYSIS OF BERG BALANCE SCALE IN CONTROL GROUP USING PAIRED 't' TEST

TABLE -- VI

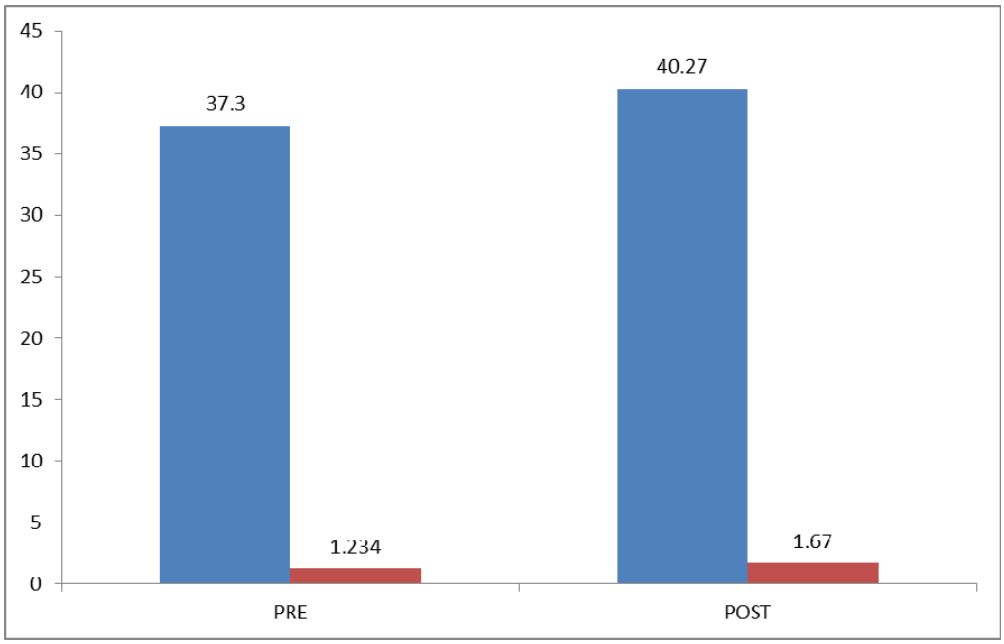
GROUP CONTROL	MEAN		SD	t	DF	Sig t value
BBS	PRE	37.3	1.234	10.33	14	2.1447
	POST	40.27	1.67			

Interpretation-Berg Balance Scale in control group-

Above table shows the mean of the pre test data for the control group as 37.3+_1.234 (SD) and post test value as 40.27±1..67 (SD). The calculated t value is 10.33. It indicates that there is significant difference between pretest and post values of Berg Balance scale in control group.

GRAPH-III

MEAN DIFFERENCE AND STANDARD DEVIATION OF BBS IN CONTROL GROUP



Interpretation of data

Statistical analysis of Berg Balance Scale in experimental group using paired 't' test

TABLE – VII

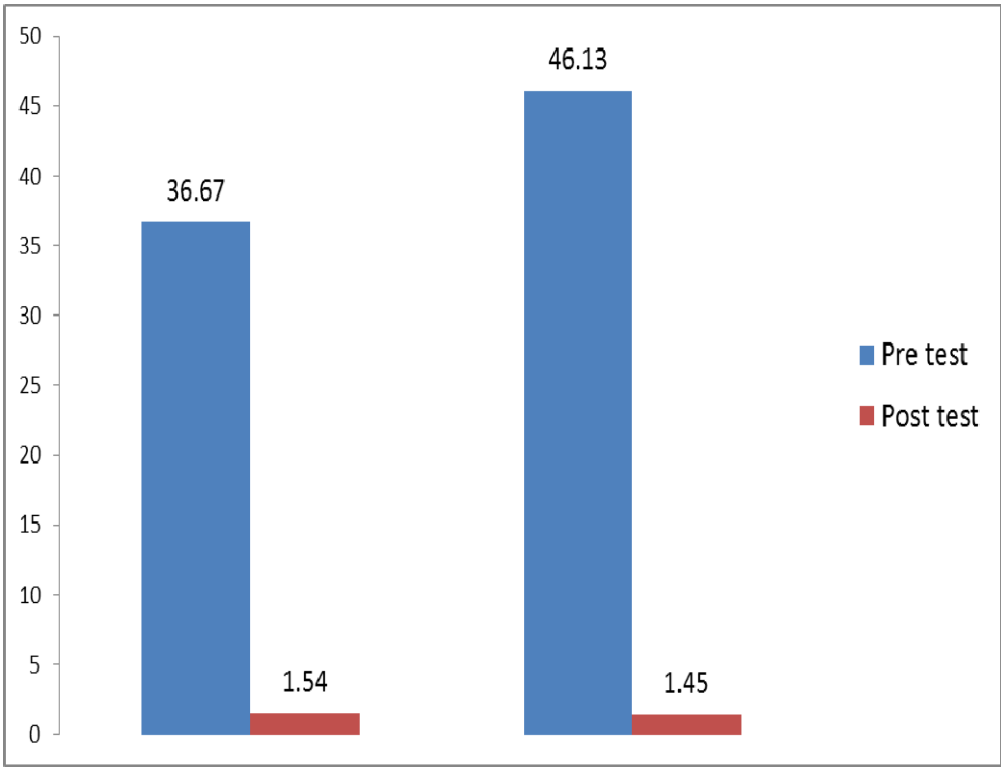
Group		Mean	S.D	't'	df
Experimental	Pre test	36.67	1.54	27.04	14
	Post test	46.13	1.45		

Interpretation - Berg balance scale

Above table shows the mean of pre test data for the experimental group as 36.67± 1.54 (SD) and post test value as 46.13±1.45 (S.D) the calculated 't' value is 27.04 which is greater than that of table value. It indicates that there is significant difference between pre test and post test values of Berg balance scale in experimental group.

GRAPH- IV

MEAN DIFFERENCE AND STANDARD DEVIATION OF BBS IN EXPERIMENTAL GROUP



STASTICAL ANALYSIS OF BERG BALANCE SCALE OF PRE TEST VALUE USING INDEPENDENT T TEST

TABLE VIII

EXPERIMENTAL AND CONTROL GROUP PRE TEST VALUE	MEAN		SD	t	DF	Sig t value
BBS	EXP	36.93	1.39	1.83	28	2.04
	CTRL	37.33	1.23			

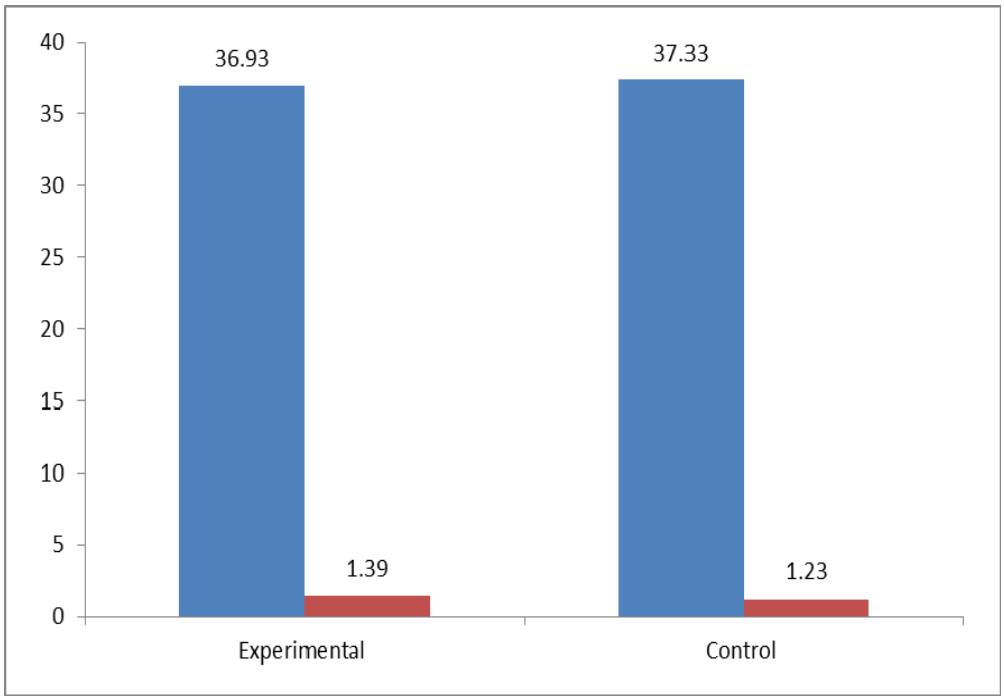
INTERPRETATION-BERG BALANCE SCALE

CONTROL AND EXPERIMENTAL GROUP PRETEST VALUE

Above TABLE shows the mean of pre test data for experimental group as 36.933 ±1.39(SD) the calculated t value is 1.8310 and control group mean 37.33±1.3810 and calculated t value is 1.8310 for both experimental and control group. It indicates that there is no significant difference between experimental and control group.

GRAPH-V

MEAN DIFFERENCE AND STANDARD DEVIATION OF BBS IN EXPERIMENTAL AND CONTROL GROUP USING INDEPENDENT 'T' TEST



STASTICAL ANALYSIS OF BERG BALANCE SCALE

POST TEST VALUE USING INDEPENDENT T TEST

TABLE - IX

EXPERIMENTAL AND CONTROL GROUP POST TEST VALUE	MEAN		SD	t	df	Sig t value
BBS	EXP	46.6	1.0521	12.6626	28	2.05
	CTRL	40.27	1.6701			

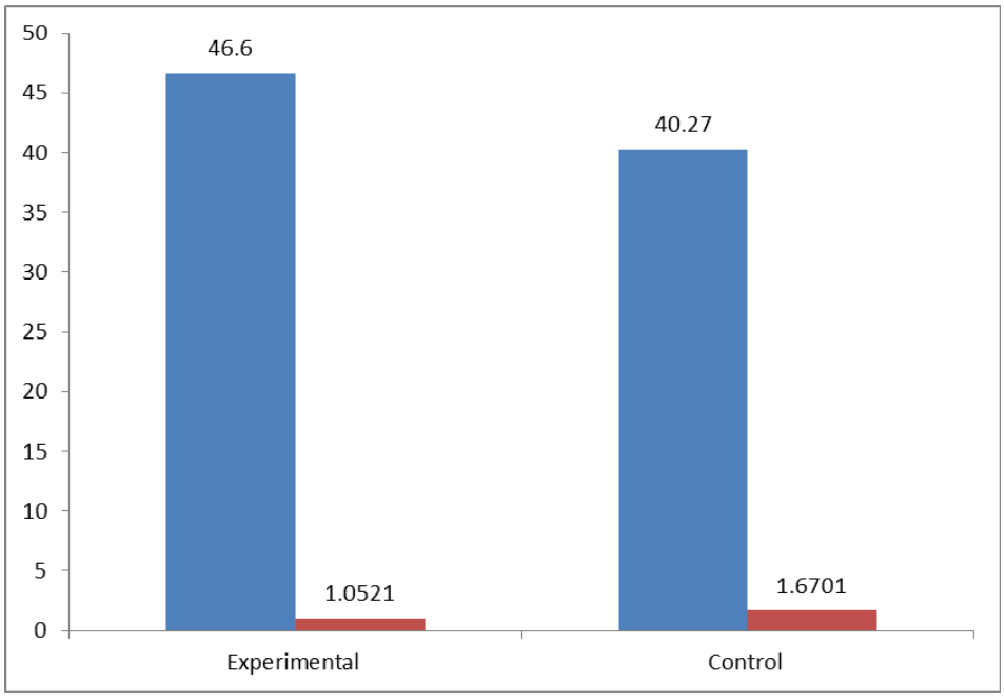
INTERPRETATION- BERG BALANCE SCALE

CONTROL AND EXPERIMENTAL GROUP POST TEST VALUE

Above table shows the mean of post test data for experimental group as 46.6 ±1.058387 (SD) the calculated t value is 12.6626 and control group mean 40.27±1.6701 and calculated t value is 12.6626 for both experimental and control group. It indicates that there is a significant difference in experimental group value than control group

GRAPH-VI

MEAN DIFFERENCE AND STANDARD DEVIATION OF BBS IN POST TEST VALUES OF EXPERIMENTAL AND CONTROL GROUP USING INDEPENDENT 'T' TEST



5. RESULTS

- Effectiveness of Control Group (Medical treatment)

While comparing the pre-test and post test values of control group using Paired 't' test, the calculated t value is 10.33 whereas the table value is 2.145, it states that there is significant difference between the pre-test and post-test values of control group. When comparing the mean values of both, the post test mean value is 1.67 which are greater than the pre test mean value 1.234. Hence it confirms that there is a significant improvement group.

- Effectiveness of Experimental Group (Balance exercise with medical treatment)

While comparing the pre-test and post test values of experimental group using Paired't' test, the calculated value is 31.8590646 whereas the table value is 2.145. Since the calculated value is more than the critical value, it states that there is significant difference between the pre-test and post-test values of experimental group. When comparing the mean values of both, the post-test mean value 46.6 which is greater than the pre-test mean value 36.933. Hence it confirms that there is a significant improvement in post-test experimental group than pre test experimental group.

6. DISCUSSION

Diabetes Mellitus is a Chronic condition which encroaches almost all the systems in the body. Diabetic neuropathy is a complication of long standing diabetes, which affects nerves of the body. Diabetic neuropathy can affect all the tissues and the organs of the body. Approximately about 60-70% of the people with diabetes suffer from neuropathy and the onset can be at any time in life . The incidence of neuropathy in diabetic patients increases with the period of diabetes.

This study was an experimental approach, which studied the effectiveness of balance exercise in diabetic neuropathy patients. The outcome was measured using Berg Balance Scale. It has been shown to a valid and reliable tool for the measurement of balance by assessing the performance of functional tasks. The control group was given medical treatment and the patient also given balance exercise in experimental group.

According to Shahin Goharpey, diabetic neuropathy results in functional imbalance which cause these patients to danger of falling during activities of daily living and becomes more severe as the severity of neuropathy aggravates. Balance exercise improves clinical measures of balance in patients with diabetic neuropathy.

Loss of pressure sensitivity was independently associated with the risk of falling more than once a year and accounts for 3- 6 % of relationship between diabetes and falling.

Based on above study, the present study concluded that balance training to be an effective means of reducing frequency of fall in patients with diabetic neuropathy.

Mechanism

The mechanism by which balance training affect the balance of diabetic neuropathy is due to,

1. During exercise whole body oxygen consumption increases in the muscles.
2. Increase in the concentration of Na^+ / K^+ adenosine triphosphatase (ATPase) pumps.
3. Exercise works to reduce insulin resistance which lowers blood sugar levels. So lowering insulin resistance will put less strain on the body to make insulin.
4. Exercise is helpful in maintaining strength, mobility, function and also provides stability

7. CONCLUSION

The study concludes that balance exercise seemed to be beneficial in improving balance and thereby reducing the frequency of fall in patients with diabetic neuropathy.

LIMITATIONS AND SUGGESTIONS

LIMITATIONS

1. Study was conducted for a short period of time.
2. The study assessed only short term progress of the patients.
3. Since study time was short only limited sample since could be considered for the study.

SUGGESTIONS

1. To establish the efficacy of the treatment a large sample size study is required.
2. To make the result more valid a long term study may be carried out.
3. The same study can be done by modifying the exercise by increasing the complexity.
4. The same study can be done by increasing the exercise by its repetitions.
5. The same study can be carried out in males and females separately.

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ANNEXURE- I

BERG BALANCE SCALE

SITTING TO STANDING

INSTRUCTIONS: Please stand up. Try not to use your hand for support.

( ) 4 able to stand without using hands and stabilize independently

( ) 3 able to stand independently using hands

( ) 2 able to stand using hands after several tries

( ) 1 needs minimal aid to stand or stabilize

( ) 0 needs moderate or maximal assist to stand

STANDING UNSUPPORTED

INSTRUCTIONS: Please stand for two minutes without holding on.

( ) 4 able to stand safely for 2 minutes

( ) 3 able to stand 2 minutes with supervision

( ) 2 able to stand 30 seconds unsupported

( ) 1 needs several tries to stand 30 seconds unsupported

( ) 0 unable to stand 30 seconds unsupported

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL

INSTRUCTIONS: Please sit with arms folded for 2 minutes.

( ) 4 able to sit safely and securely for 2 minutes

( ) 3 able to sit 2 minutes under supervision

( ) 2 able to sit 30 seconds

( ) 1 able to sit 10 seconds

( ) 0 unable to sit without support 10 seconds

STANDING TO SITTING

INSTRUCTIONS: Please sit down.

( ) 4 sits safely with minimal use of hands

( ) 3 controls descent by using hands

( ) 2 uses back of legs against chair to control descent

( ) 1 sits independently but has uncontrolled descent

( ) 0 needs assist to sit

TRANSFERS

INSTRUCTIONS: Arrange chair(s) for pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.

( ) 4 able to transfer safely with minor use of hands

( ) 3 able to transfer safely definite need of hands

( ) 2 able to transfer with verbal cuing and/or supervision

( ) 1 needs one person to assist

( ) 0 needs two people to assist or supervise to be safe

STANDING UNSUPPORTED WITH EYES CLOSED

INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.

( ) 4 able to stand 10 seconds safely

( ) 3 able to stand 10 seconds with supervision

( ) 2 able to stand 3 seconds

( ) 1 unable to keep eyes closed 3 seconds but stays safely

( ) 0 needs help to keep from falling

STANDING UNSUPPORTED WITH FEET TOGETHER

INSTRUCTIONS: Place your feet together and stand without holding on.

( ) 4 able to place feet together independently and stand 1 minute safely

( ) 3 able to place feet together independently and stand 1 minute with supervision

( ) 2 able to place feet together independently but unable to hold for 30 seconds

( ) 1 needs help to attain position but able to stand 15 seconds feet together

( ) 0 needs help to attain position and unable to hold for 15 seconds

REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING

INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at the end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)

( ) 4 can reach forward confidently 25 cm (10 inches)

( ) 3 can reach forward 12 cm (5 inches)

( ) 2 can reach forward 5 cm (2 inches)

( ) 1 reaches forward but needs supervision

( ) 0 loses balance while trying/requires external support

PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION

INSTRUCTIONS: Pick up the shoe/slipper, which is in front of your feet.

( ) 4 able to pick up slipper safely and easily

( ) 3 able to pick up slipper but needs supervision

( ) 2 unable to pick up but reaches 2-5 cm(1-2 inches) from slipper and keeps balance independently

( ) 1 unable to pick up and needs supervision while trying

( ) 0 unable to try/needs assist to keep from losing balance or falling

TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING

INSTRUCTIONS: Turn to look directly behind you over toward the left shoulder. Repeat to the right. (Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.)

( ) 4 looks behind from both sides and weight shifts well

( ) 3 looks behind one side only other side shows less weight shift

( ) 2 turns sideways only but maintains balance

( ) 1 needs supervision when turning

( ) 0 needs assist to keep from losing balance or falling

TURN 360 DEGREES

INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.

( ) 4 able to turn 360 degrees safely in 4 seconds or less

( ) 3 able to turn 360 degrees safely one side only 4 seconds or less

( ) 2 able to turn 360 degrees safely but slowly

( ) 1 needs close supervision or verbal cuing

( ) 0 needs assistance while turning

ANNEXURE – 2

ASSESSMENT FORM

A. DEMOGRAPHIC DATA

Name:

Age: Date of admission :

Sex: Date of assessment:

Occupation:

Marital status:

Chief complaints:

B. HISTORY

Present medical history

a) Onset:

b) Duration:

c) Symptoms:

Past medical history

Diabetes Mellitus : Yes/No

Duration:

Detected now/…..years

Medication : Yes/No, regular/irregular

Present status : Controlled/uncontrolled

Any other relevant illness : Yes/No

Family History

Personal History

a) Physical activities : Active/Inactive

b) Smoking and duration

c) Alcohol intake : Yes/No

d) Personality type : Calm/Anxious

Socioeconomic History

C. ON OBSERVATION

Physical built

Attitude of the limb

Tropical changes

External appliances

Others

D. ON PALPATION

Warmth

Tenderness

Swelling

Muscle firmness

Distal pulses

Others

E. ON EXAMINATION

1. Vital signs

Heart rate

Blood Pressure

Respiratory

Temperature

2. Neurological Examination

- Level of consciousness(GCS)
- Mini mental state test

Memory: Short/Intermediate/Long

Orientation

Intelligence

Attention

Speech

Cranial Nerve Examination

3. Motor Examination

a) Power

Upper limb Right Left

Lower Limb Right Left

b) Tone

Upper Limb

Lower Limb

c) Reflexes

Superficial reflex

Deep reflex

d) Voluntary control

e) Range of motion

Upper Limb Right Left

Lower Limb Right Left

4. Sensory examination

a) Exteroception: normal/abnormal

Touch

Temperature

Pain

b) Proprioception: normal/abnormal

Joint position sense

Kinesthetic sense

Vibration

c) Combined and cortical sensation: normal/Abnormal

Stereogonosis

Tactile localization

Two point discrimination

Barognosis

Graphaesthesia

5. Gait

Normal/Spastic/Ataxic/Hemiplegics

Cadence: Symmetrical/Asymmetrical

Arm swing

Base: Narrow/Broad

6. Co-ordination: Equilibrium/Non equilibrium

7. Balance

8. Posture

9. Deformity

10. Bladder and Bowel

11. Cranial Nerve Examination

12. Hand function:

Normal/Partially

Affected moderately

Affected fully

Affected

F. INVESTIGATION

C T Scan

MRI

Other investigations

Blood

EEG

G. PROBLEM LIST

Primary

Secondary

H. PROVISIONAL DIAGNOSIS

I. TREATEMENT

Goals

Means

J. FOLLOW UP

CONSENT FORM

I. ……..voluntarily consent to participate in the research study named **"A STUDY ON THE EFFECTIVENESS OF BALANCE EXERCISE IN IMPROVING BALANCE IN PATIENTS WITH DIABETIC NEUROPATHY"**

The researcher had explained to me the treatment approach in detail, risk of the participants and had answered the questions related to the research to my satisfaction.

Participant's Signature:

Signature of the Witness:

Signature of the Researcher: